Exhibit 1

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Kelly et al.

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(54) **OIL FILTER ASSEMBLY**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **17/406,639**

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(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 63/068,759, filed on Aug. 21, 2020.

(51) **Int. Cl.**
F01M 11/03 (2006.01)

(52) **U.S. Cl.**
CPC ***F01M 11/03*** (2013.01); *F01M 2011/033* (2013.01)

(58) **Field of Classification Search**
CPC F01M 11/03; F01M 2011/033
USPC ..... 123/196 A
See application file for complete search history.

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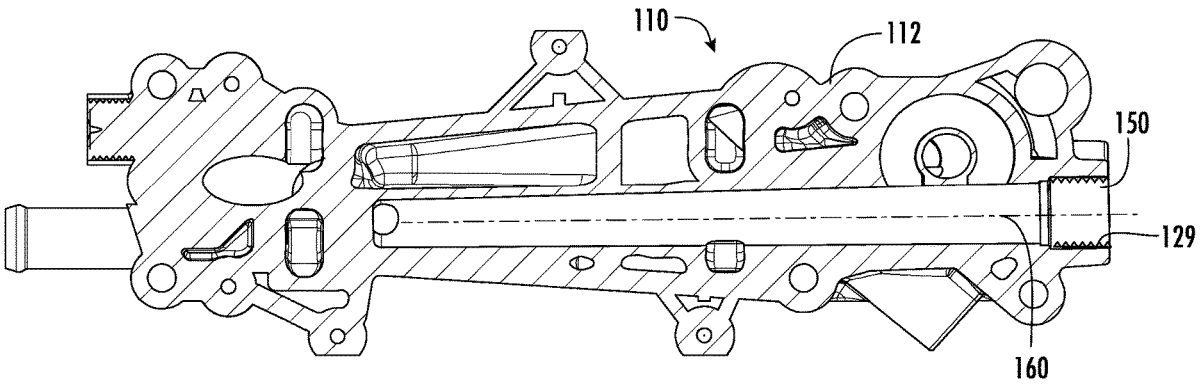
(57) **ABSTRACT**

A cast metallic adaptor for a filtering and cooling assembly that eliminates the needs for inserts or plugs and provides for direct threading of associated components to the adaptor. This construction also provides an enclosed flow path with a common axis for improved durability against burst pressure, heat and age degradation, and conditions related to cycling.

12 Claims, 4 Drawing Sheets



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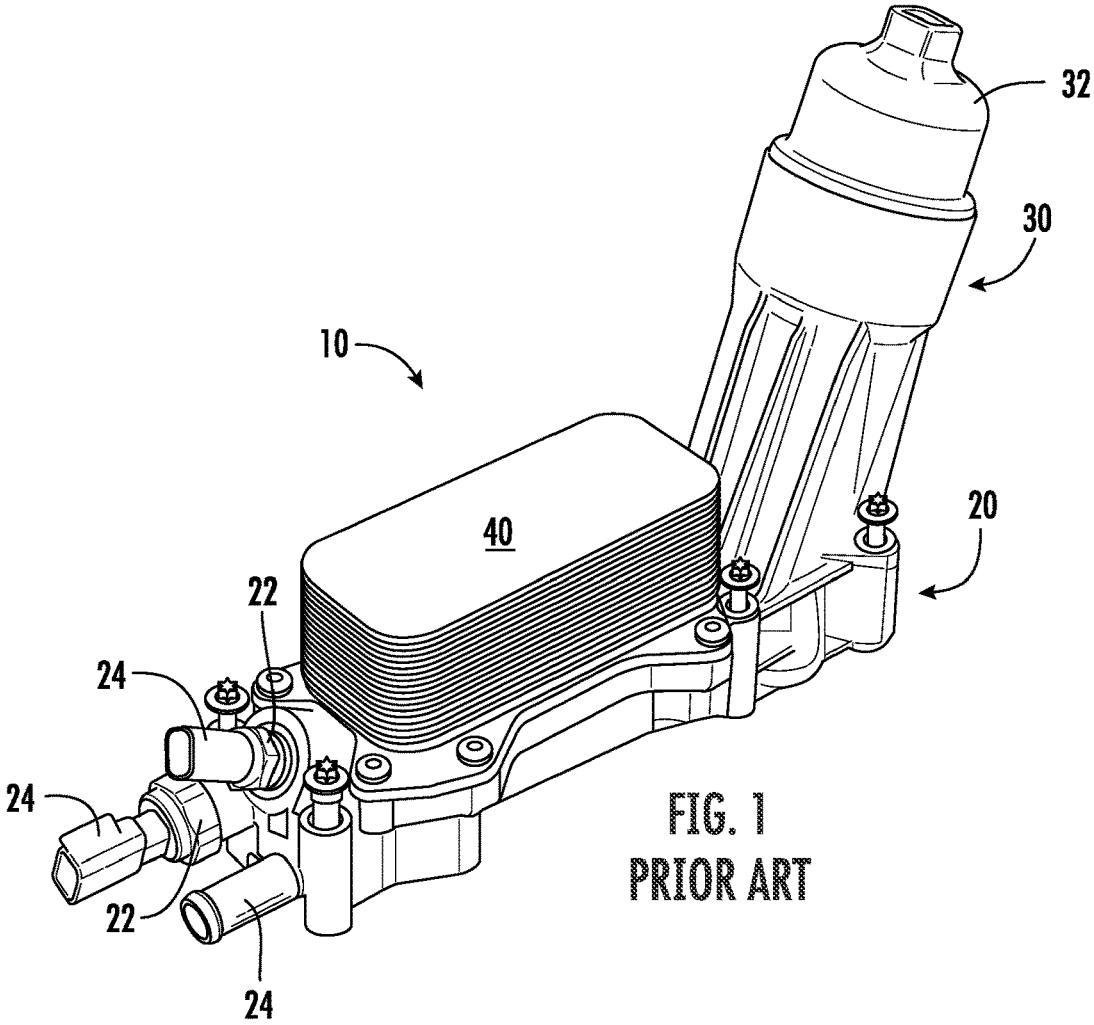


FIG. 1
PRIOR ART

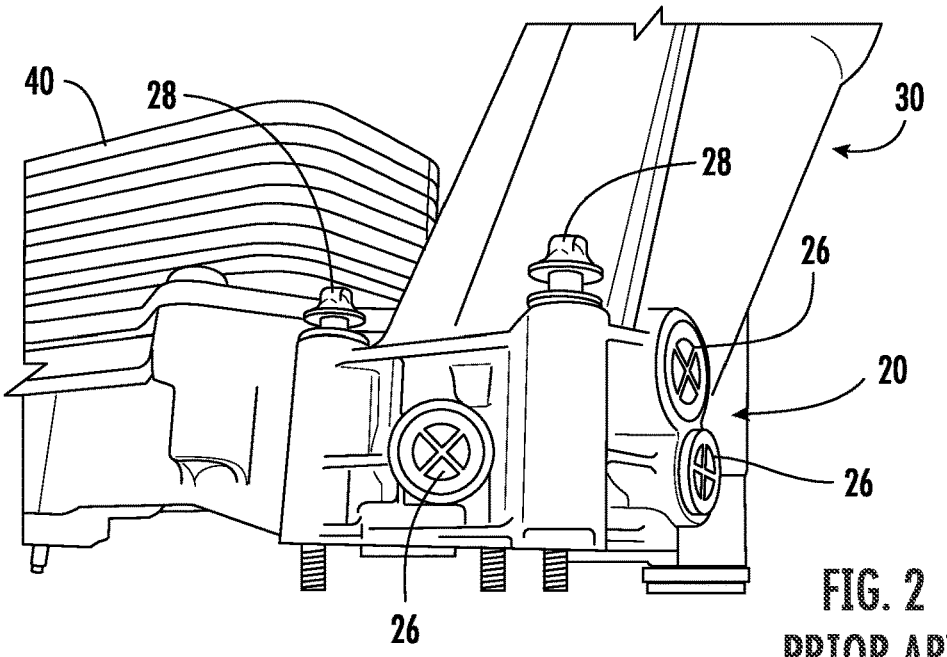


FIG. 2
PRIOR ART

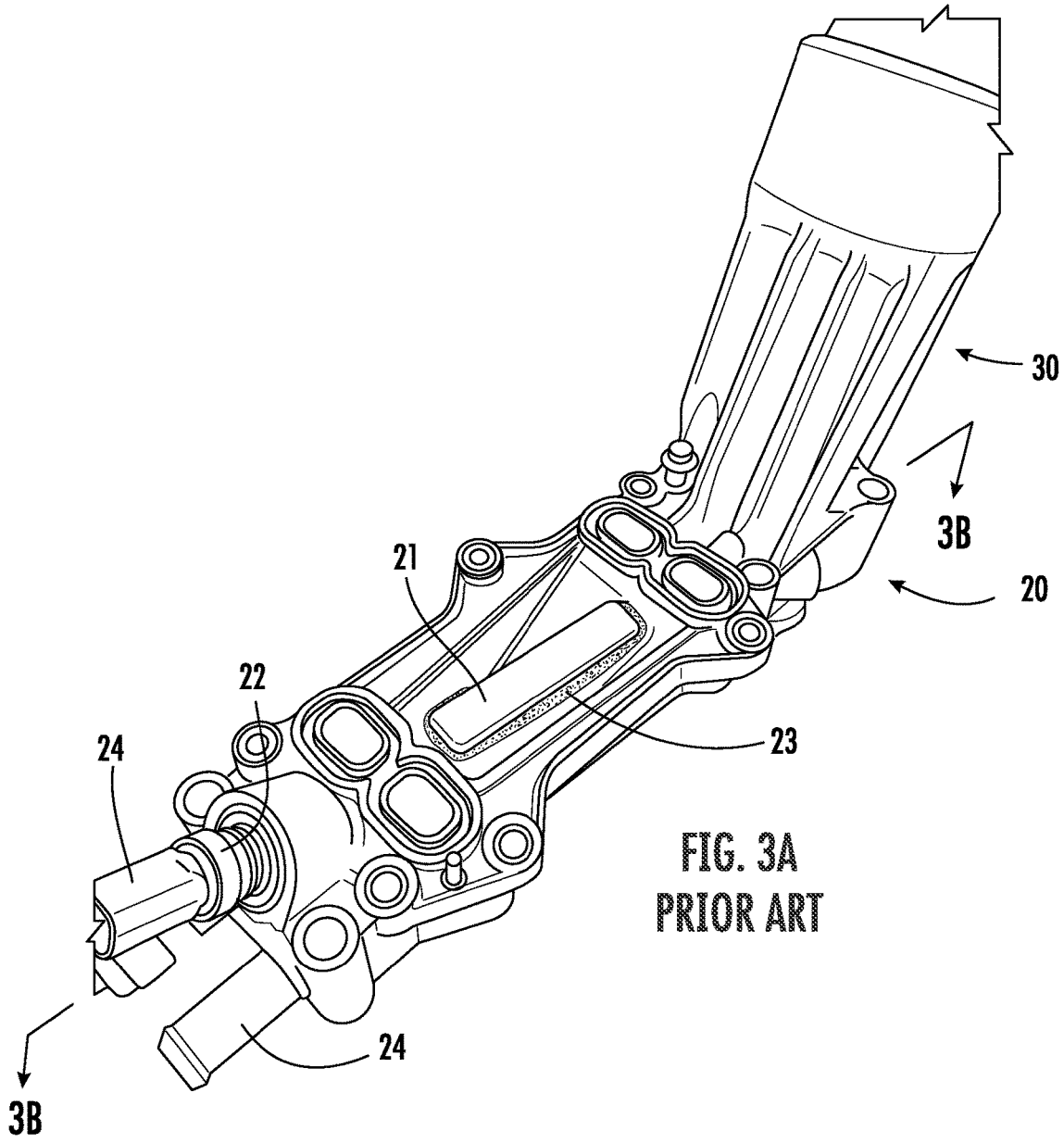


FIG. 3A
PRIOR ART

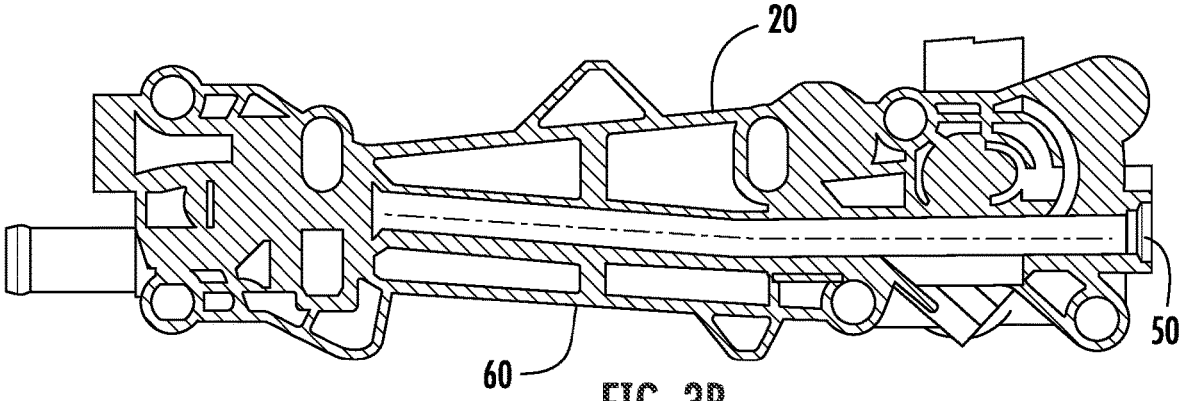
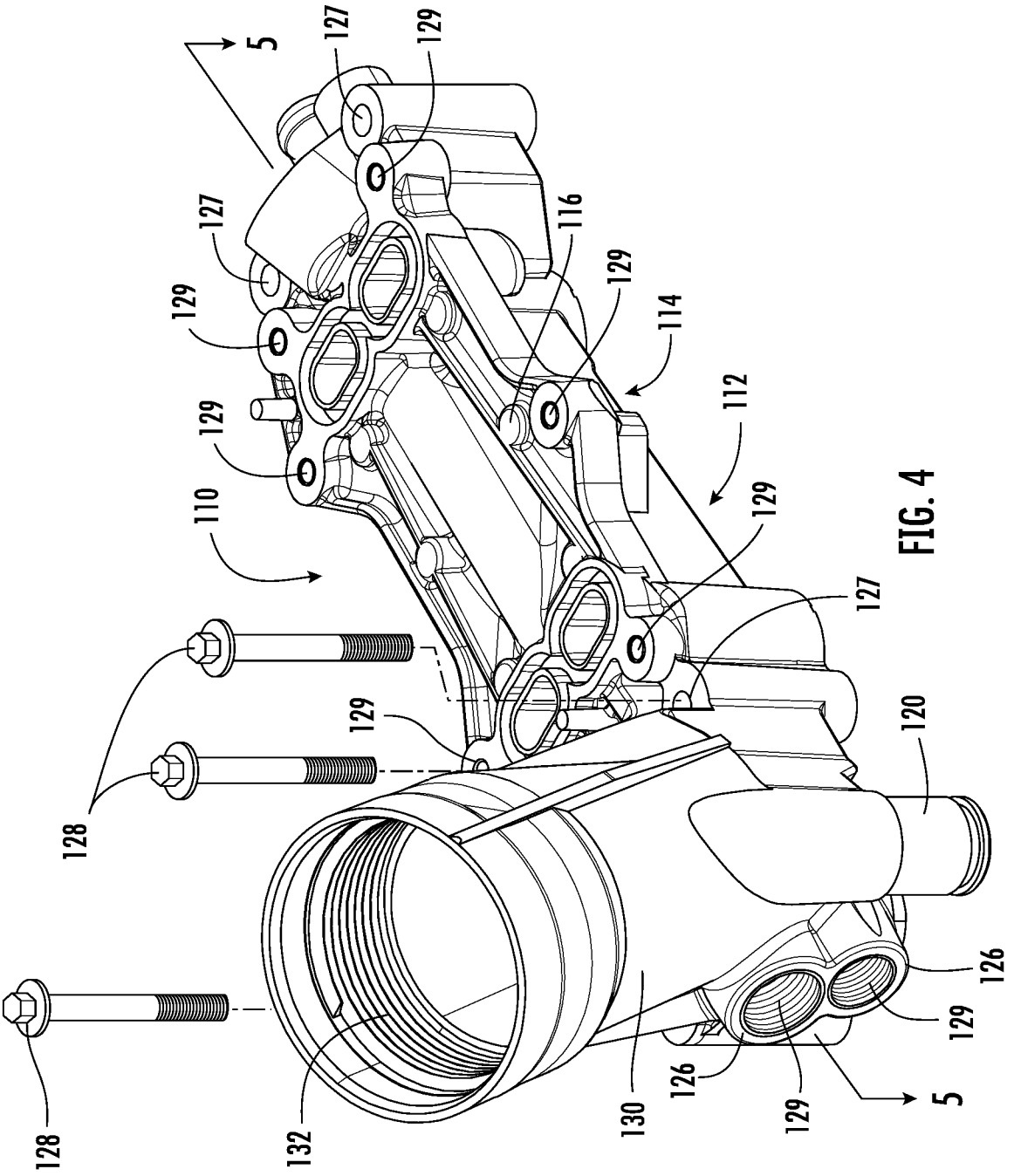


FIG. 3B
PRIOR ART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127
129
127
116
129
129
114
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112
110
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120
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126
129
128
132

FIG. 4

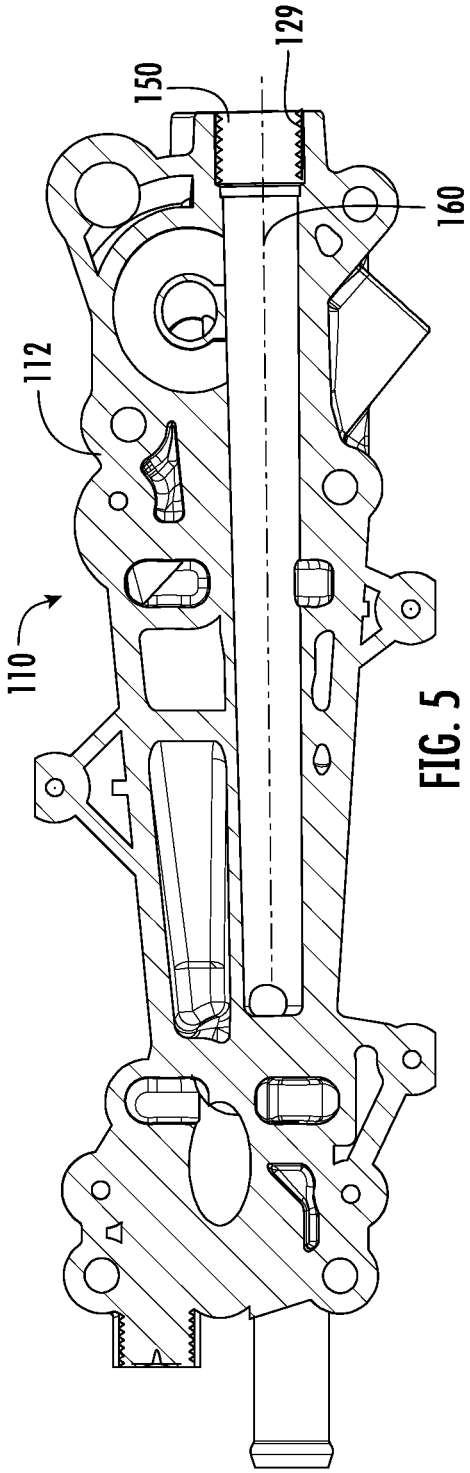
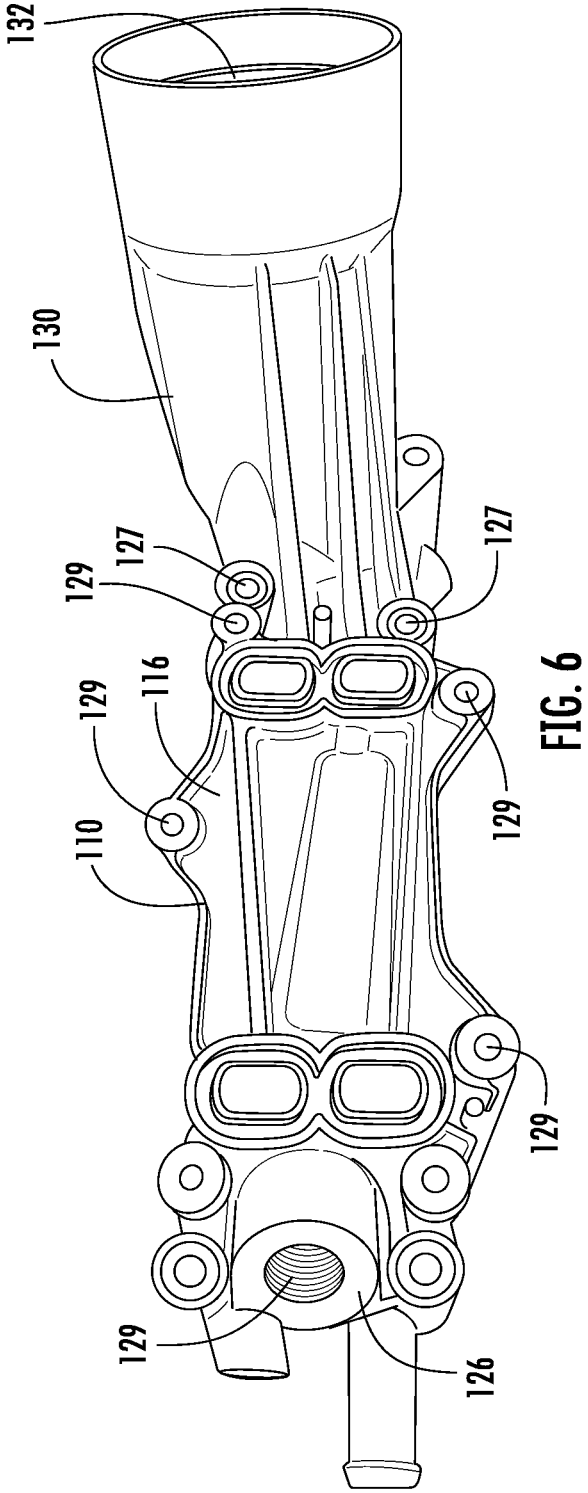

129
150
160
112
110

FIG. 5


132
130
127
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116
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110
129
129
126

FIG. 6

OIL FILTER ASSEMBLY

CROSS REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application No. 63/068,759, filed on Aug. 21, 2020, which is incorporated by reference as if fully set forth.

FIELD OF INVENTION

The invention relates generally to the lubrication of mechanical engines that utilize oil as a lubricating fluid that circulates though defined galleries in the engine. More particularly, the invention relates to a lubrication system where the lubricating fluid is routinely passed through a filter element, which is generally replaceable at certain intervals, and potentially and oil cooler. Most particularly, the invention relates to an adaptor for a lubrication system that incorporates the oil filter housing and an oil cooler in an assembly that is often located within the motor valley.

BACKGROUND

Modern engines, especially though used in motor vehicles, seek to reduce weight and size while maintaining the desired power. As part of the effort to reduce weight, many parts are being made in plastic and many parts are being combined in assemblies to further reduce weight by eliminating individual connection points. While this trend has proven successful in some areas, it has introduced problems where one or more portions of a plastic assembly experience a failure. Under these conditions, it is often necessary to disassemble unrelated parts of the engine in order to gain access to the assembly and make the necessary repairs.

Another drawback to plastic assemblies is the need to made accommodations for various sensors and system components that need to be connected to the assembly. These connections are most often achieved by molding an opening in the plastic component and attaching a metallic insert to achieve the connection. This plastic to metal connection can be difficult to properly seal. An addition failure point of this metal-plastic connector is the possibility of over tightening the inserted component, such as a sensor fitting or cap, and stressing or damaging the surrounding plastic.

In addition to the above associated with a hybrid plastic-metallic assembly, the molding process requires certain concessions in order to permit molding cores to be inserted and removed during the molding process. An associated drawback with the plastic molding is the need to remove core elements used in the process and reseal the molding which leads to further potential failure points. In addition, the unused molded openings that require closing plugs that must be glued or welded in the unused openings. These plugs represent another failure point in the plastic-metallic assembly.

SUMMARY

The applicants have discovered that a cast metallic part provides a robust assembly that avoids the needs for inserts, eliminates the need for plugs, and provides for direct threading of components to the adaptor. As a result of eliminating the assembly of multiple molded parts, the performance and durability is improved against burst pressure, heat and age degradation, and conditions related to cycling. In addition, the single metallic casting provides a flow path without the need for adhesives and resealing of the flow path.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a prior art oil filter adaptor and cooler assembly;

FIG. **2** is a partial rear view of the prior art assembly in FIG. **1**;

FIG. **3**A illustrates the capping of the oil flow path in the prior art adaptor after removal of the core used in the plastic molding;

FIG. **3**B is a section illustrating the flow path in the prior art adaptor;

FIG. **4** is a perspective view of an adaptor according to the invention prior to assembly of any related components;

FIG. **5** is a section view along the line **5-5** in FIG. **4** showing the linear flow path in an adaptor according to the invention; and,

FIG. **6** is a perspective view of an adaptor according to the invention in a direction opposite to that of FIG. **4**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The prior art oil filter assembly shown in FIGS. **1-3**B is typical of the adaptor construction resulting from using moldable plastic materials. The prior art assembly **10** in FIG. **1** has a base **20**, a filter housing **30** and an oil cooler **40**. The base **20** includes medal inserts **22** that are provided in the plastic construction at designated locations for the attachment of other associated components. The metal inserts and associated components are shown in FIG. **1** at **22** and **24** respectively. Although the metal inserts are frequently molded in situ during the molding of the plastic base, they remain a failure point and can result in oil leakage or worse. The metal inserts **22** are also subject to overtightening during attachment of the associated components **24**, which can result in stress cracks in the plastic.

As shown in FIG. **2**, the base **20**, due to the molding process requiring the ability to withdrawal a core, has a number of plugs **26** that are retrofitted after the base **20** is molded. The plugs **26** are assembled to the molded base with an adhesive or spin welding. In either event, the plugs **26** are a failure point in the base **20** that can result in oil leaking or worse.

In addition to the inserts **22** and plugs **26**, the base **20** has a number of metal inserts or sleeves, not shown, that are inserted to reinforce the plastic molded apertures for attachment of the various bolts **28** that hold the assembly **10** together. Here again, the inserts or sleeves introduce a potential failure point. Another potential failure point is the attachment of the cap **32** to the plastic filter housing **30**. Over tightening of the cap **32** can introduce stress fracture in the threaded housing **30**.

With reference to FIGS. **3**A and **3**B, it can be seen that the prior art flow path **50** requires a cover **21**, at least partially over the flow path, that is adhered to the base after the molding core is removed by the adhesive or welding **23**. With reference to FIG. **4**B, it can be seen that the flow path **50** bends or is angular; in other word, the flow path **50** does not have a common longitudinal axis.

With reference to FIG. **4**, the preferred adaptor **110** has an elongated body **112**, which has a lower surface **114** that mates with a lubrication network and an upper surface **116** that mates with a cooling component, a filter housing **130** and base **120** that is formed of a casted metallic material,

preferably aluminum. The elongated body **112**, base **120** and the filter housing **130** are casted together and the apertures **127** for receiving the bolts **128** do not required metal inserts or sleeves to avoid stressing or cracking do to the solid metallic construction. The casting is also threaded at **129** to receive fasteners for securing an oil cooler **40** and external connectors to the adaptor **110**.

Still with reference to FIG. **4**, the casted filter housing **130** has internal threaded **132** that mate with an OEM cap **32** to secure a filter within housing **130**. In a similar manner, the apertures **126** have internal threading to preferably mate with NPT plugs that are self-sealing. Depending on the type and construction of related components, such as sensors, it may be necessary to employ a gasket or sealing rings with their assembly.

With reference to FIG. **5**, the flow path **150** for transporting the lubricant within base **120** to connect with the internal lubrication network is centered about the longitudinal axis **160** and consistent throughout the base **120**. The flow path **150** is symmetric about the axis **160** and there is no angular component in the flow path **150** as it is connected with the internal lubrication network. The flow path **150** is entirely within the unitary casting so there is no need for adding a closure to the flow path.

With the exception of the flow path **150**, the lubrication galleries and the location positions for associated components are identical to the OEM assembly so the casted metal adaptor is a direct replacement for the OEM part and no modifications or relocations of other components are necessary.

As shown in FIGS. **4** and **6**, the adaptor **110**, including the filter housing **130** and the base **120** outwardly appearance the same as the OEM part and the base accepts the OEM cooler **40** and the filter housing accepts the cap **32** without any modification.

What is claimed is:

1. An adaptor for connecting an oil filter and an oil cooler to an engine, the adaptor comprising:

a single metallic casting having:

an elongated body with a lower surface configured to mate with an oil lubrication network in an engine, an oil filter housing is defined at a first end of the elongated body, and an upper surface that is configured to mate with an oil cooler;

wherein the elongated body includes an oil lubrication flow path that is wholly within the elongated body and extends between an oil lubrication network in an engine, and the oil filter housing, and at least one threaded aperture is formed in the single metallic casting for receiving at least one additional component in a direct threaded engagement with the single metallic casting.

2. The adaptor of claim **1** wherein the oil flow path within the elongated body is symmetric about a longitudinal axis and has a substantially linear flow path.

3. The adaptor of claim **1** wherein there is at least one threaded aperture for receiving at least one additional component in a direct threaded engagement is position at a second end of the elongated body.

4. The adaptor of claim **1** wherein the elongated body includes a plurality of casted apertures that are threaded for receiving a respective threaded fastener directly in the elongated body to secure a cooling component to the upper surface of the elongated cast metallic body.

5. An adaptor for securing an oil filter and an oil cooler in an assembly with an engine, the adaptor comprising:

a single metallic casting with an elongated body having a housing at a first end configured to receive a filter and at least one location in the body that is threaded for directly attaching an additional component at a second end, and an upper surface of the single metallic casting having a plurality of threaded apertures between the first end and the second end that are is configured to attach an oil cooler thereon; and,

a unitary fluid flow path is contained within the elongated body between the first end and the second end that has a common longitudinal axis and an oil lubrication network in an engine.

6. An oil filtering assembly for an engine, the assembly comprising:

a single metallic casting having:

a housing formed at a first end of the metallic casting that is configured to receive a fluid filter and a housing closure;

a closure that is configured to mate with and close the housing;

a second end of the metallic casting is remote from the first end and includes at least one location of the metallic casting that is threaded for attaching a threaded component directly to the metallic casting;

a portion of the metallic casting between the first end and the second end of the metallic casting has an upper surface and a lower surface; and,

an enclosed flow path entirely within the single metallic casting is centered about a common axis and extends between the first end and the second end of the single metallic casting;

wherein the upper surface of the metallic casting is configured to receive and secure a cooler between the first end and the second end of the metallic casting; and,

the lower surface of the metallic casting is configured to mate with oil flow paths within an engine.

7. The oil filtering assembly of claim **6** wherein the flow path is symmetric about a longitudinal axis and is substantially linear.

8. The oil filtering assembly of claim **6** wherein the first end has at least one cast aperture that is threaded for receiving at least one threaded component in a direct threaded engagement with the single metallic casting.

9. The oil filtering assembly of claim **6** wherein the adaptor includes a plurality of casted apertures that are threaded directly in the single metallic casting for receiving a respective threaded fastener to secure a cooler with the elongated cast metallic body.

10. The adaptor of claim **5** wherein the elongated metallic body includes a plurality of casted apertures that are threaded directly in the single metallic casting for receiving a respective threaded fastener to secure a cooler with the elongated metallic body.

11. An adaptor for connecting an oil filter and an oil cooler to an engine, the adaptor being a single metallic casting having:

an elongated body with a lower surface configured to mate with an oil lubrication network in an engine, an oil filter housing at a first end of the elongated body, and an upper surface that is configured to mate with an oil cooler;

wherein the elongated body includes: an enclosed oil lubrication flow path that is casted wholly within the elongated body and the extends between an oil lubrication network in an engine, and the oil filter housing; and, at least one aperture with threads formed directly in the single metallic casting for receiving at least one

threaded component in a direct threaded engagement with the single metallic casting.

12. The adaptor of claim **10**, wherein the upper surface has a plurality of threaded apertures positioned for attachment of an oil cooler.

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